A Web-Based Survey to Estimate the Economic Value of Improved Hurricane Forecasts

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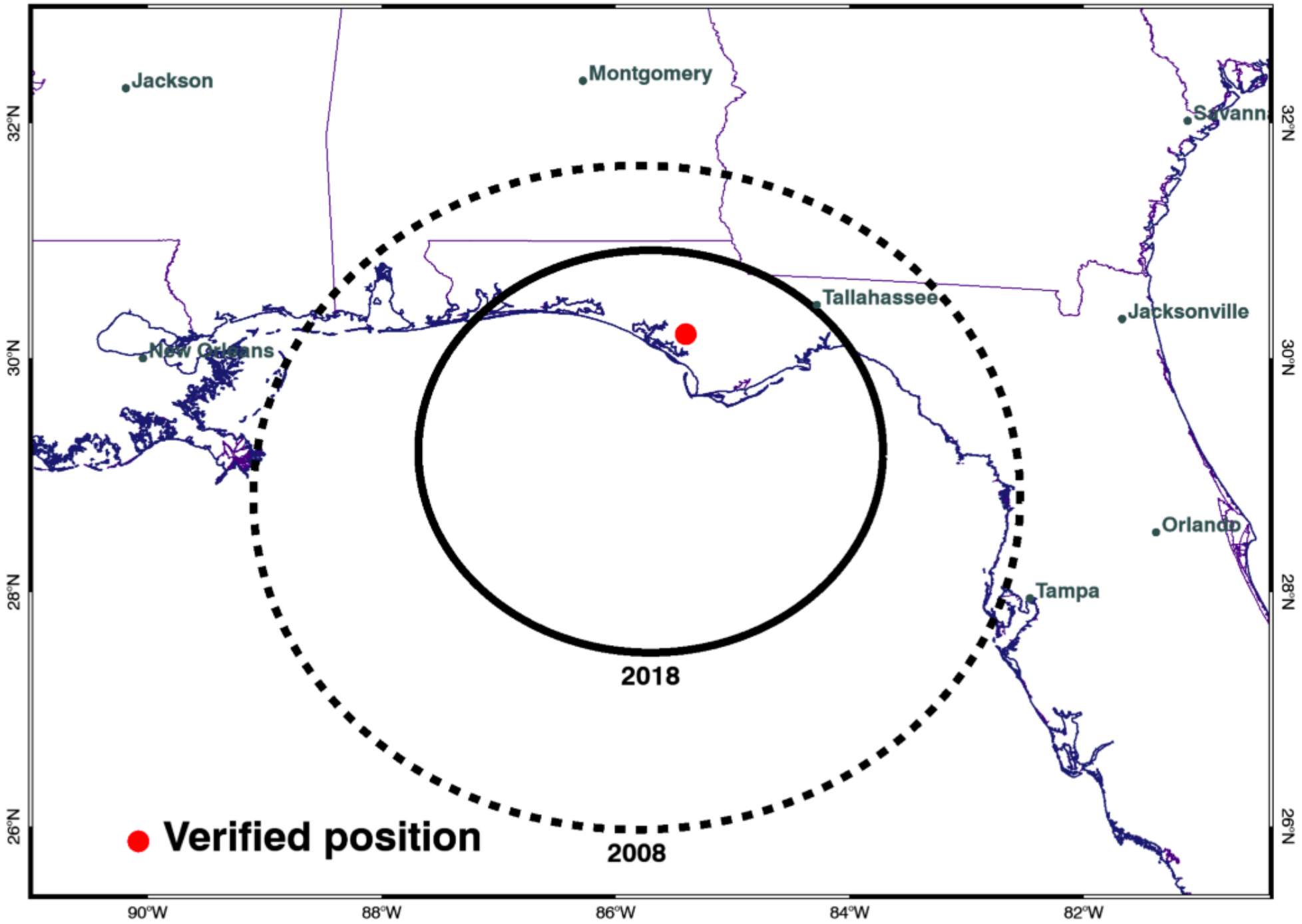
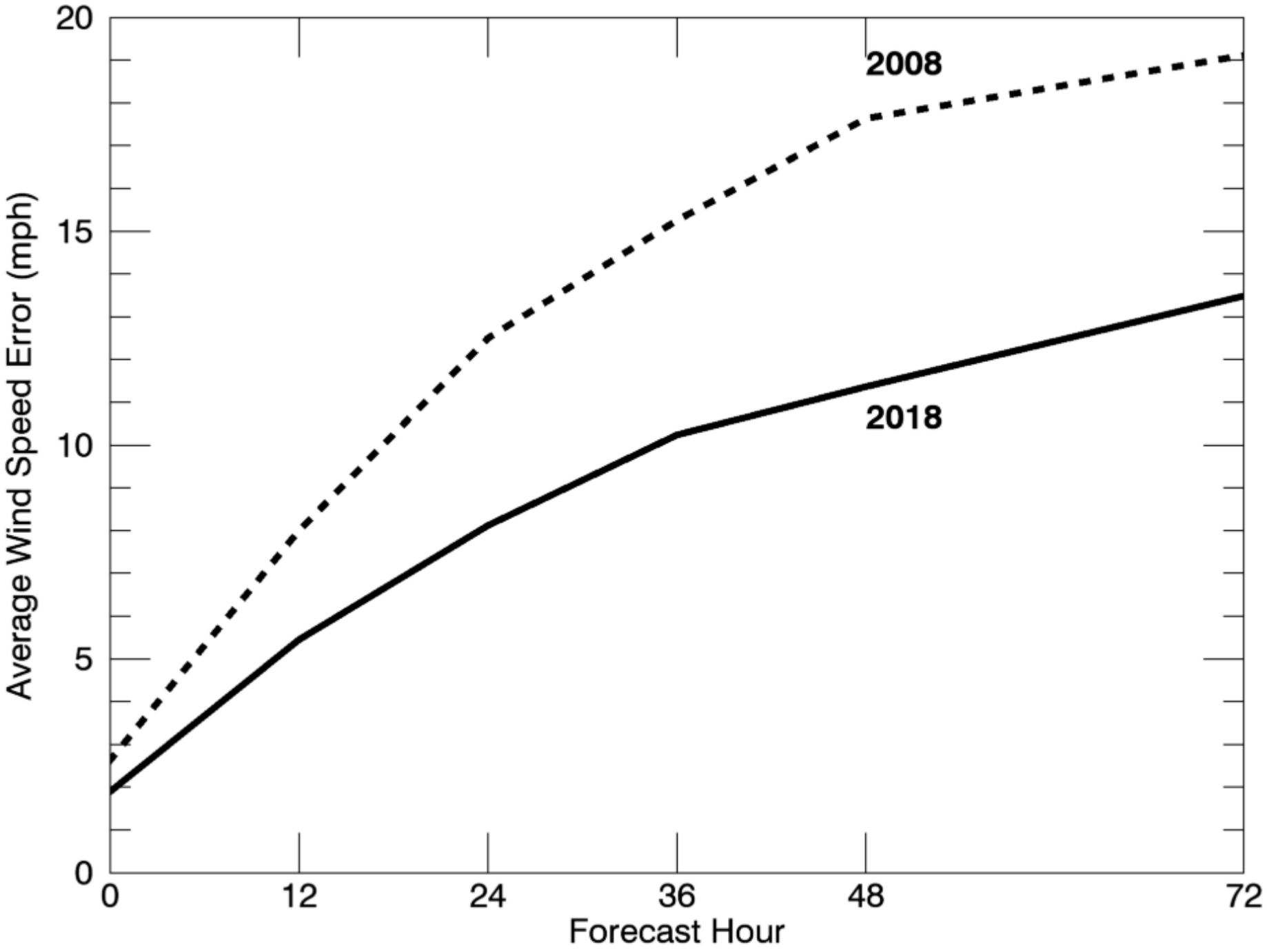
Why do we have forecast?

- Because people can take adaptive measures against the expected impact of a given hurricane
- Because the government can also take adaptive measures against the expected impact of a given hurricane
- Otherwise, there is no point in forecasting hurricanes, or any other natural disaster for that matter

What do we know about hurricane forecasts?

- They are getting better
  - In 2008, the 67% confidence interval for a three-day track forecast was about 195 miles
  - In 2018, the same interval was 118 miles
- Progress has been mostly driven by the Hurricane Forecast Improvement Project (HFIP, 2007 - 2017)
  - 50% track improvement – 40% achieved
  - 50% intensity improvement – 43% achieved
- How good is this rate of improvement?
- How has society benefitted from it?


Jackson
Montgomery
Savann
Tallahassee
Jacksonville
New Orleans
Orlando
Tampa
32°N
30°N
28°N
26°N
90°W
88°W
86°W
84°W
82°W
2018
2008
Verified position


20
15
10
5
0
Average Wind Speed Error (mph)
2008
2018
0
12
24
36
48
72
Forecast Hour

Do the public value **further** improvements in hurricane forecast?

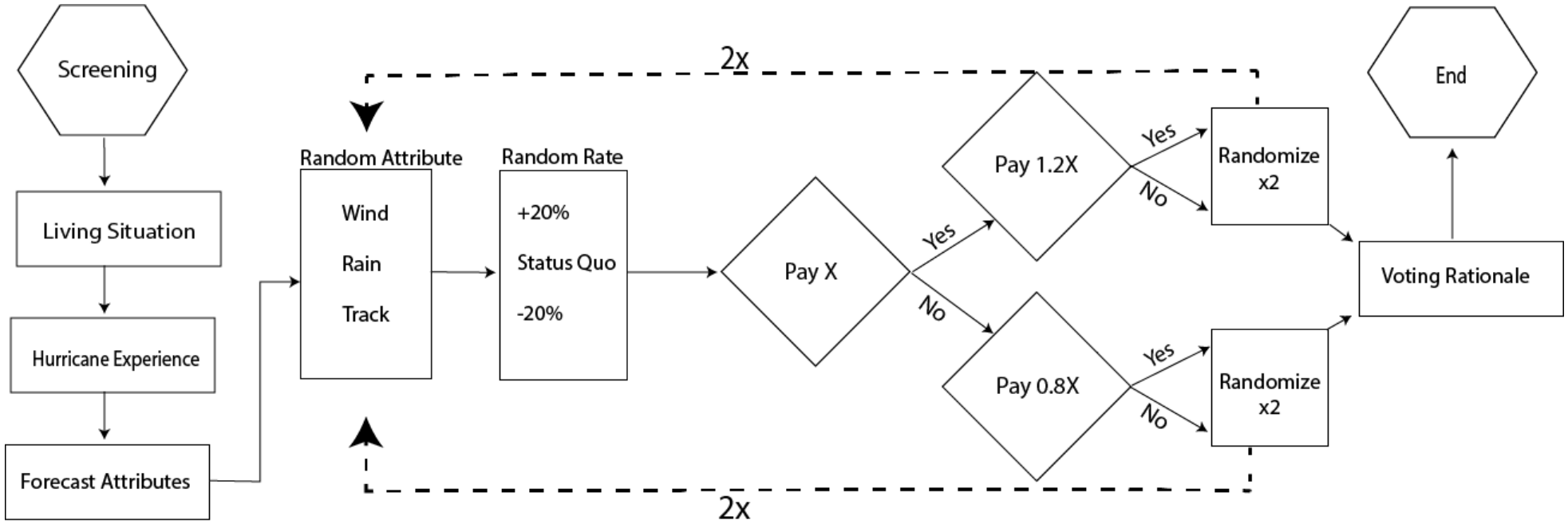
Not an easy question

- What does it mean to have a better forecast from the public's perspective?
  - Model is better
  - Results from the model are communicated better
- For our project, we focus on model accuracy and leave communication improvements aside
- Study focuses on "**this is what you saw**" vs "**this is what you would have seen**" with a better model
- We target populations that have recently experienced a hurricane

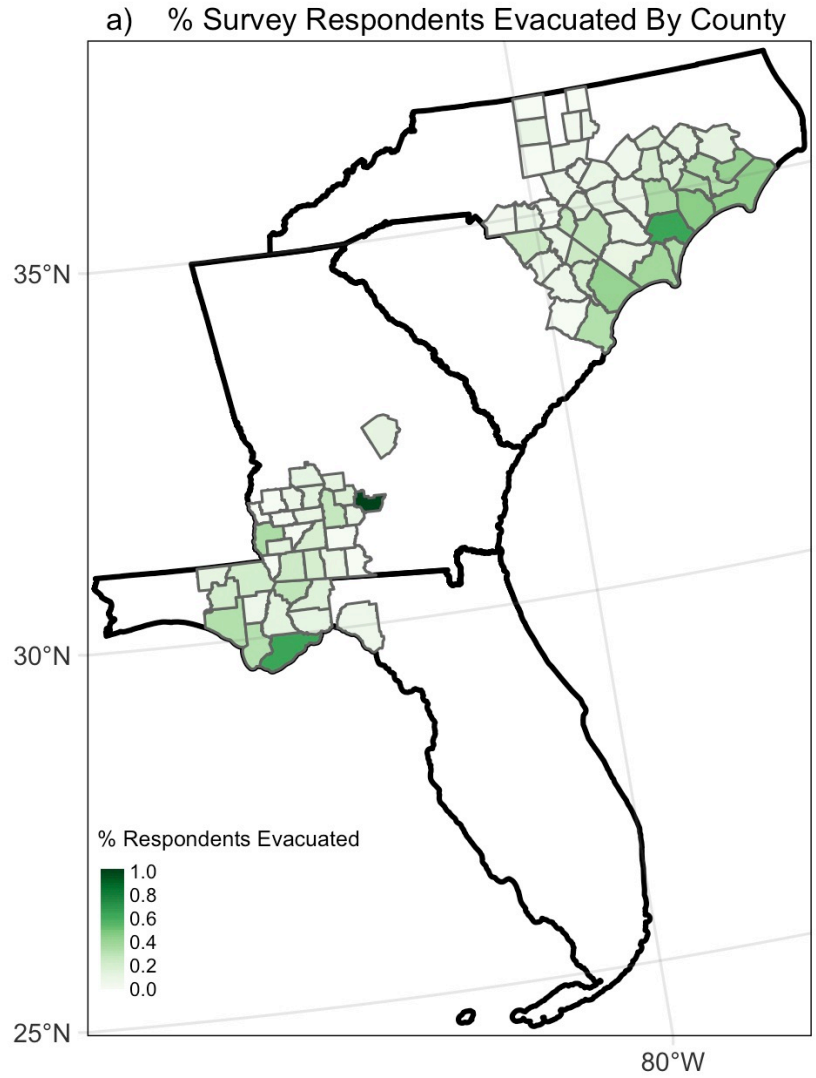
Methodology

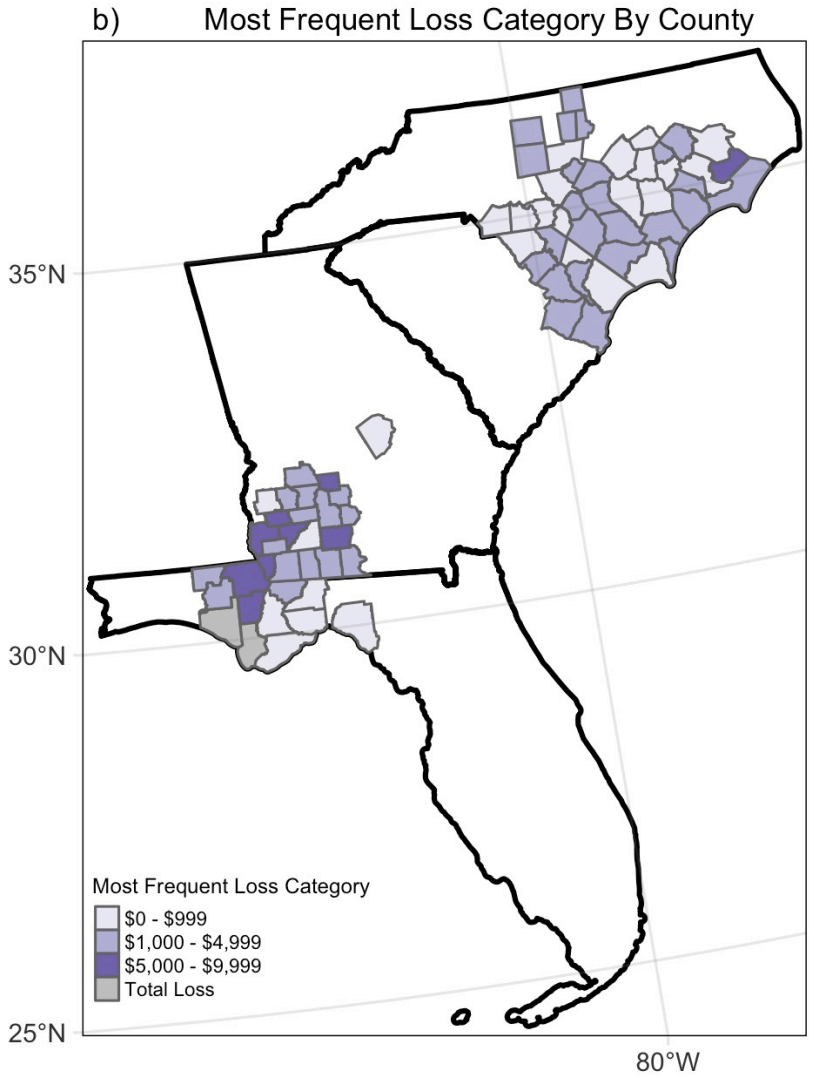
- Double-bounded dichotomous choice elicitation to evaluate the willingness to pay for forecast improvement
- Scenarios based on structural meteorological models
  - Track – Time window for evacuation
  - Wind speed – Saffir-Simson category
  - Precipitation – Inches
- Large representative samples from recently affected areas
  - Florence (3150)
  - Michael (1500)

Survey strategy

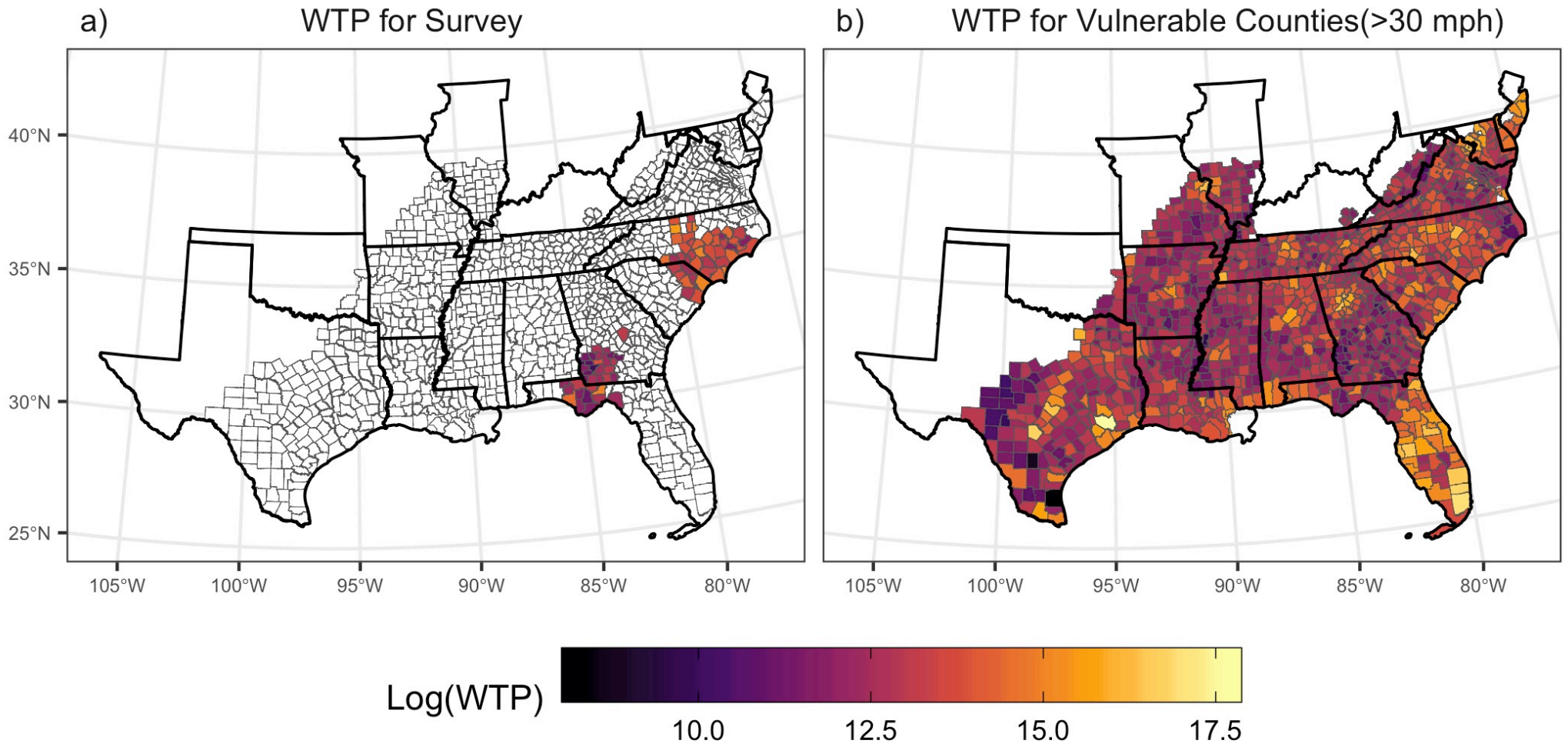


Survey respondents





Willingness to pay (WTP)



In words

- The average WTP for households in the sample is between $16 to $26 a year for a better forecast
- Aggregating across counties affected by Michael and Florence suggests the total WTP is about $39 to $60 million a year
- Willingness to pay across attributes:
  Wind speed > Storm track > Precipitation
- Extrapolating these results to susceptible population suggest WTP is between $8 to $12 a year per person

Discussion I

- Respondents value further improvements in forecast accuracy – statistically insensitive to improvement rate
- While all forecast attributes are positively valued, wind speed is valued the most
- Pattern is likely associated with wind speed and Saffir-Simpson categories serving as proxies for damages
- These findings suggest that research contributing to increased forecast accuracy is valuable – orders of magnitude larger than NHC's research budget

Discussion II

- You should be suspicious!

- Survey studies have many caveats:
  - Yeah saying
  - Getting the right answer
  - Trying to free ride the system***

- Are respondents assigning value to improvements in the forecast or at our suggestion that they are better?

Can we say something about the value of forecasting without having to directly ask people?

Value of information – Future work

- People vote with their feet!
- The goal is to recreate forecasts, actual storms, and the damages they cause
- As people build mental models of the accuracy of forecasts based on these observations, they engage in adaptive behavior
- By examining purchases, traffic and emergency deployments, we will empirically estimate these models and **subjectively** quantify the value of forecast improvement

Thanks!

Questions? Comments?